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Pesticide Fact Sheet Number 21: Carbaryl

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US Environmental Protection Agency
Office of Pesticide Programs
Registration Division, TS-767C
401 M Street, S.W.
Washington, D.C. 20460

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This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

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United States
Environmental Protection
Agency

Office of Pesticides and Toxic Substances
Office of Pesticide Programs (TS-766C)
Washington, DC 20460

EPA

Pesticide Fact Sheet

Name of Chemical: CARBARYL
Reason for Issuance: Registration Standard
Date Issued: 03/30/84 - Revised 09/05/85
Fact Sheet Number: 21

1. DESCRIPTION OF CHEMICAL

Generic Name: 1-Napthyl N-methylcarbamate

Common Name: Carbaryl

Trade Name: Sevin

EPA Shaughnessy Code: 056801

Chemical Abstracts Service (CAS) Number: 63-25-2

Year of Initial Registration: 1958

Pesticide Type: Insecticide

Chemical Family: Carbamate

U.S. and Foreign Producers: Union Carbide
Makteshim Chemical Works, Inc.

2. USE PATTERNS AND FORMULATIONS

Application Sites: Citrus, pome, stone and berry fruits, forage, field and vegetable crops, nuts, lawns, forests, ornamental plants, rangeland, shade trees, poultry and pets, indoor use

Types of Formulations: Baits, dusts, granules, wettable powders, flowables and aqueous dispersions

Types of Methods of Application: Ground and aerial

Application Rates: Range from 0.53 lbs. a.i./A to 6.4 lbs. a.i./A

Usual Carriers: Synthetic clays, talc, various solvents

3. SCIENCE FINDINGS

Summary Science Statement

Carbaryl has moderate to low mammalian toxicity. It is not considered to be an oncogen. It is a weak mutagen. Available data

indicates that carbaryl has only low teratogenic potential. Long term dietary studies in rats and dogs and a short term study in humans (highest dose only) demonstrate an apparent effect on renal function.

No reentry interval is necessary for carbaryl. The Agency is requesting data to determine if carbaryl will contaminate groundwater. Data are insufficient to assess the environmental fate of carbaryl.

Carbaryl is extremely toxic to aquatic invertebrates and certain estuarine organisms. It is extremely toxic to honey bees. It is moderately toxic to both warmwater and coldwater fishes and has only low toxicity to birds.

A full tolerance reassessment cannot be completed. A one year dog feeding study is required as well as residue data on numerous processed commodities.

Chemical Characteristics

Physical State: Crystalline solid

Color: White

Odor: Essentially odorless

Melting point: 142° C

Vapor Pressure: < 0.005 mm Hg at 26°C

Flash Point: 380°F

Toxicology Characteristics

Acute Oral LD_{50}: 255 mg/kg, Toxicity Category II

Acute Dermal LD_{50}: > 2 g/kg, Toxicity Category III

Primary Dermal Irritation: No irritation, Toxicity Category IV

Primary Eye Irritation: Conjunctival irritation at 24 hours. Cleared at 48 hours. Toxicity Category III

Acute Inhalation LC_{50}: Data gap

Oncogenicity: Ten studies. Each study classified as "supplemental." Collectively these studies provide sufficient evidence that carbaryl is not oncogenic in experimental

animals. Eighteen month mouse study was negative at 400 ppm. A 2 year rat feeding and oncogenicity study was negative at 200 ppm.

Teratogenicity: Twenty-four studies have been evaluated to determine the teratogenic potential of carbaryl. In evaluating these studies some were found to be flawed. Other studies demonstrated no teratogenicity or maternal toxicity. There are studies which demonstrate teratogenic effects although the doses also caused maternal toxicity. Two studies produced teratogenic effects in the beagle dog. These two studies are the primary reason carbaryl was made a candidate for RPAR in 1976.

The Agency has concluded (45 FR 81869) that carbaryl does not constitute "a potential human teratogen or reproductive hazard under proper environmental usage". The Agency has determined that the dog is a poor model to use for teratogenicity testing. The Agency has determined that a label precaution stating not to use carbaryl on pregnant dogs is warranted

There have been proposals that there are differences in the metabolism of carbaryl between the dog and man. These differences, however, have never been demonstrated. Therefore, a metabolism study in the beagle dog versus the rat is being required. This metabolism study should allow us to determine if there are meaningful differences between the dog and other mammalian species.

Reproduction: A rat three generation study was negative at 200 mg/kg.

Mutagenicity: Carbaryl is characterized as a weak mutagen. The Agency has determined that carbaryl does not pose a mutagenic risk. No additional data are being requested.

1-year Dog Feeding Study:
2-year Rat Feeding Study: Demonstrated an apparent effect on renal function. A kidney effect was also noted in a short-term human study. A one year dog feeding study using carbaryl is being requested in order to determine the effects of carbaryl on kidney dysfunction. The results of these may necessitate a re-evaluation of the ADI for carbaryl.

Physiological and Biochemical Behavioral Characteristics

Mechanism of Pesticidal Action: A contact insecticide which causes reversible carbamylation of the acetylcholinesterase enzyme of tissues, allowing accumulation of acetylchloline at

cholinergic neuroeffector junctions (muscarinic effects), and at skeletal muscle myoneural junctions and autonomic ganglia. Poisoning also inpairs the central nervous system function.

Metabolism and Persistence in Plants and Animals: Carbaryl is rapidly excreted in animals, mainly in the urine. Residues in animals are carbaryl, 1-naphthol and hydroxycarbaryl. The hydroxy metabolites are found mainly as glucuronide and sulfate conjugates. Carbaryl is slowly taken up into plants, after which it is metabolized. The disappearance of carbaryl residue from plant surfaces is attributed to mechanical attribution, volatization and uptake into plant. Photochemical degradation does not appear to be a factor. 1-Naphthol is the major metabolite.

Environmental Characteristics

Available data are insufficient to fully assess the environmental fate of carbaryl.

Adsorption and Leaching in Basic Soil Types: The Agency is requesting data to determine if carbaryl will contaminate groundwater.

Microbial Breakdown: Carbaryl is degraded by fungi. The soil fungi attack carbaryl by hydroxylation of the side chain and ring structure.

Loss from Photodecomposition: Data gaps. Data are required

Bioaccumulation: Preliminary data indicate that there may be a potential for carbaryl and its residue(s) to accumulate in catfish, crayfish, snail, duckweed and algae. Additional data are requested.

Resultant Average Persistance: Carbaryl is metabolized by pure and mixed cultures of bacteria, fungi, and to some extent by other soil and water organisms. The half-life appears to range from 7 to 28 days in aerobic and anaerobic soils, respectively.

Ecological Characteristics

Avian oral LD_{50} -
Mallard duck: > 2179 mg/kg
Ring necked pheasant: > 2000 mg/kg

Avian dietary LC_{50} -
Mallard duck: > 5000 ppm

Ring-necked pheasant: > 5000 ppm
Bobwhite quail: > 5000 ppm

Freshwater Fish LC_{50} -
Coldwater fish: rainbow trout - 1.95 ppm
Warmwater fish: bluegill sunfish - 6.76 ppm

Acute LC_{50} Freshwater Invertebrates -
Daphnia pulex - 6.4 ppb

Acute LC_{50} Estuarine and Marine Organisms: Data gap. Data being requested.

Freshwater Fish Early Life-Stage -
Fathead minnow - Maximum Acceptable Theoretical Concentration (MATC) - >0.21<0.68 ppb

No precautionary language is required for birds or fish. However, carbaryl is highly toxic to aquatic invertebrates. There is insufficient information to characterize the chronic toxicity of carbaryl to aquatic invertebrates.

Tolerance Assessments

The Agency is unable to complete a full tolerance reassessment because of certain residue chemistry and toxicology data gaps, namely a one year dog feeding study and the need for residue data on various processed food commodities.

Tolerances:

Commodity	Parts Per Million
Alfalfa	100
Alfalfa	100
Almonds	1
Almonds, hulls	40
Apples	10
Apricots	10
Asparagus	10
Bananas	10
Barley, grain	0
Barley, green fodder	100
Barley, straw	100
Beans	10
Beans, forage	100
Beans, hay	100
Beets, garden (roots)	5
Beets, garden (tops)	12

Tolerances:

Commodity	Parts Per Million
Birdsfoot trefoil, forage	100
Birdsfoot trefoil, hay	100
Blackberries	12
Blueberries	10
Boysenberries	12
Broccoli	10
Brussels sprouts	10
Cabbage	10
Carrots	10
Cauliflower	10
Celery	10
Cherries	10
Chestnuts	1
Chinese cabbage	10
Citrus fruits	10
Clover	100
Clover, hay	100
Collards	12
Corn, fresh (including sweet) Kernel(K) - Corn with husk removed(CWHR)	5
Corn, fodder	100
Corn, forage	100
Cotton, forage	100
Cottonseed	
Cowpeas	5
Cowpeas, forage	100
Cowpeas, hay	100
Cranberries	10
Cucumbers	10
Dandelions	12
Dewberries	12
Eggplants	10
Endive (escarole)	10
Filberts (hazelnuts)	1
Flax, seed	5
Flax, straw	100
Grapes	10
Grass	100
Grass, hay	100
Horseradish	5
Kale	12
Kohlrabi	10
Lentils	10
Lettuce	10
oganberries	12

Tolerances:

Commodity	Parts Per Million
Maple sap	0.5
Melons	10
Millet, proso, grain	3
Millet, proso, straw	100
Mustard greens	12
Nectarines	10
Oats, fodder, green	100
Oats, grain	0
Oats, straw	100
Okra	10
Olives	10
Oysters	0.25
Parsley	12
Parsnips	5
Peaches	10
Peanuts	5
Peanuts, hay	100
Pears	10
Peas (with pods)	10
Peavines	100
Pecans	1
Peppers	10
Pistachio nuts	1
Plums (fresh prunes)	10
Poultry, fat	5
Poultry, meat	5
Potatoes	0.2(N)
Prickly pear cactus, fruit	12.0
Prickly pear cactus, pads	12.0
Pumpkins	10
Radishes	5
Raspberries	12
Rice	5
Rice, straw	100
Rutabagas	5
Rye, fodder, green	100
Rye, grain	0
Rye, straw	100
Salsify (roots)	5
Salsify (tops)	10
Sorghum, forage	100
Sorghum, grain	10
Soybeans	5
Soybeans, forage	100
Soybeans, hay	100
Spinach	12
Squash, summer	10
Squash, winter	10

Tolerances:

Commodity	Parts Per Million
Strawberries	10
Sugar beets, tops	100
Sunflower seeds	1
Sweet potatoes	0.2
Swiss chard	12
Tomatoes	10
Turnips, roots	5
Turnips, tops	12
Walnuts	1
Wheat, fodder, green	100
Wheat (grain)	3
Wheat, straw	100
Cattle, fat	0.1
Cattle, kidney	1
Cattle, liver	1
Cattle, meat	0.1
Cattle (mbyp)	0.1
Goats, fat	0.1
Goats, kidney	1
Goats, liver	1
Goats, meat	0.1
Goats (mbyp)	0.1
Horses, fat	0.1
Horses, kidney	1
Horses, liver	1
Horses, meat	0.1
Horses (mbyp)	0.1
Sheep, fat	0.1
Sheep, kidney	1
Sheep, liver	1
Sheep, meat	0.1
Sheep (mbyp)	0.1
Swine, fat	0.1
Swine, kidney	1
Swine, liver	1
Swine, meat	0.1

Based on established tolerances the theoretical maximum residue contribution (TMRC) for carbaryl residues in the human diet is calculated to be 5.48 mg/day. The acceptable daily intake (ADI) of carbaryl is 0.1 mg/kg/day. The maximum permissible intake (MPI) is 6 mg/day. To provide for conformity between U.S. tolerances for carbaryl and tolerances established by the Codex Alimentarius, Canada and Mexico, the expression of the U.S. tolerances for carbaryl will be changed to omit reference to 1-naphthol.

A one year dog feeding study is being requested in order to determine the effects of carbaryl on kidney dysfunction. The results of these data may require that the ADI for carbaryl be recalculated.

U.S. tolerances for most raw agricultural commodities are supported by current residue chemistry data. In some cases, however, more data are required.

4. SUMMARY OF REGULATORY POSITION AND RATIONALE

The Agency has determined that it should continue to allow the registration of carbaryl. Adequate studies are available to assess the acute toxicological effects of carbaryl to humans. None of the criteria listed in section 162.11(a) of Title 40 of the U.S. Code of Federal Regulations have been met or exceeded. However, because of gaps in the data base a full risk assessment of carbaryl cannot be completed.

A full tolerance reassessment cannot be completed because of certain residue chemistry and toxicology data gaps, namely a one year dog feeding study and the need for residue data on various processed commodities.

No federal or state reentry intervals have been established for carbaryl or will be established.

Available data are insufficient to fully assess the environmental fate of carbaryl. The Agency is requesting data to determine if carbaryl will contaminate groundwater.

5. SUMMARY OF MAJOR DATA GAPS

Residue data on various processed commodities
One year dog feeding study
Hydrolysis study
Photodegradation studies
Soil metabolism studies
Mobility studies
Dissipation studies
Accumulation studies
Metabolism study in dog versus rat

6. CONTACT PERSON AT EPA

Jay S. Ellenberger
Product Manager (12)
Insecticide-Rodenticide Branch Registration Division (TS-767C)
Office of Pesticide Programs
Environmental Protection Agency 401 M Street, S. W.
Washington, D. C. 20460

Office location and telephone number:
Room 202, Crystal Mall #2
1921 Jefferson Davis Highway
Arlington, VA 22202
(703) 557-2386

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